

phyll escapes from the corpuscle, "together with certain fluid or semi-fluid substances which accompany it, in the form of viscid drops, leaving the ground substance of the corpuscle as a colorless, apparently protoplasmic, hollow sphere, with a much perforated wall."

By this means Dr. Pringsheim was able to get some little idea of the nature of Hypochlorin, a substance whose existence in chlorophyll-corpuscles he had previously announced. Under the acid treatment this substance appears as dark brown masses which eventually assume a crystalloidal appearance. From the fact that no hypochlorin can be detected when the corpuscles are warmed in water or exposed to steam it is inferred that it is decomposed by heat.

The effects of intense light upon the various cell contents are very interesting. It appears that although under ordinary circumstances the chlorophyll-corpuscles lose their color when exposed to intense light, such will not be the case in the absence of oxygen or in red light. This leads to the conclusion that this decolorization is a result of oxidation and the products gases.

An unexpected conclusion of Dr. Pringsheim is that in this same chlorophyll corpuscle are carried on the diametrically opposite functions of assimilation and respiration. The apparent contradiction is explained thus. The coloring matter of the chlorophyll-corpuscles absorbing certain rays of light permit the protoplasmic base of the corpuscles to do the work of assimilation; but this same absorbed light, thus kept from the protoplasmic base, can do the work of respiration. If therefore light is too intense these rays are not all absorbed and respiratory work overbalances that of assimilation. Mr. Vines states Prof. Pringsheim's principal results as follows:

"1. That the presence of chlorophyll favors the assimilatory activity of the chlorophyll-corpuscle in consequence of the absorption, by the chlorophyll, of light, which would promote respiratory activity.

2. That hypochlorin is the substance which is the first visible product of this assimilative activity, and that the other substances (starch, glucose, oil, tannin) which are found in chlorophyll corpuscles are derived from hypochlorin by oxidation."—J. M. C.

**Some New Mexican Ferns. II.**—Three *Notholænas* grow here, all of great beauty. The largest, *N. sinuata*. Kaulfuss, is a very peculiar fern, as well as a very handsome one. The fronds grow in clumps of five or six, and are from one to two feet long, while their extreme width is less than two inches. It is simply pinnate, the pinnae large, roundish, and crenate-sinuate, alternate on the rachis, of a bright green color above, and below covered very densely with a yellowish-brown pubescence which becomes darker as the season advances. It is from the color of the lower side that it receives its common name of "The Golden Fern." It usually grows among rocks on the hillsides, where it is exposed to the brightest sunshine. When it grows in the shade it becomes very tall and slender, and somewhat drooping. It fruits during October.

*Notholæna Hookeri*, D. C. Eaton, rarely reaches a foot in height;

the whole height being occupied by the stalk. The palmate frond is attached to the stalk almost at a right-angle. The upper surface is of a bright light-green and the under surface is covered with a pulveraceous substance, which gives it a very bright, light yellow color, growing darker with age. When the fruit is fully mature it forms a margin of an intense black, which contrasts finely with the general surface.

It grows at the edges of rocks, in dense and rather large tufts, and is the only one of my ferns which is handsomer than *Pellaea flexuosa*. It matures its spores quite early in October. Like *Cheilanthes Lindheimeri*, it curls up and becomes unfit for pressing almost as soon as it is removed from the soil.

*Notholaena dealbata*, Kunze, like *Cheilanthes lanuginosa*, grows in tufts on the perpendicular sides of rocks, where there seems to be no soil whatever, and in the deepest shade. It is seldom more than eight inches in height, the fronds finely divided, and very bright colored, the upper surface being green, while below it is of a pure white. When the fruit appears it is of the deepest black, and disposed in irregular, stellate, or radiating spots. Later the fruit becomes so abundant as to almost completely cover the back of the frond. A tuft of this fern, exhibiting the fronds in various stages of maturity, the colors varying from a pure white to an almost regular black, is a very pretty object. This is one of the earliest fruiting species.

*Woodsia Oregana*, D. C. Eaton, resembles our own *Woodsias* in its general appearance, but the stalks are more herbaceous and delicate. It is rather common, but not abundant, growing singly under the edges of overhanging rocks at the bottom of canons, in deep shade, and always near the water-holes. My variety differs from the type in having the stalks scaly, and in having narrow wings to the midrib. The latter peculiarity is probably connected with a habitual monstrosity which will be noticed in the conclusion. It is among the very early fruiting species.

The only remaining species is *Gymnogramme hispida*, D. C. Eaton. This is quite common and abundant. It grows in very high and dry situations, but in rich soil, and moderate shade. It seems to grow more luxuriantly in the shade, but so late is it in maturing that in such situations the chances are much in favor of its being destroyed by cold and dry weather before it has fruited.

It grows to the height of two to four inches, and, like *Notholaena Hookeri*, the frond exhibits its face in a nearly, or quite, horizontal position. The frond is pedate and densely hispid on both surfaces, but most so below. The upper surface is of a rich, dark green, the under surface of a grayish-green, and late in the season, both are tinged with red. The articulation is slight, and it is difficult to avoid separating the fronds from the rootstock in pressing.

In conclusion, a few teratological notes are in order. The teratology of ferns has of late attracted considerable attention, and I believe that Mr. Davenport is at present engaged in some special studies in this direction. Attention has been principally attracted to the bifurcation of the fronds, and in the recently established "Terato-

logical column" of that enterprising botanical journal, *The Bulletin of the Torrey Botanical Club*, Mr. Davenport and others have directed attention to a number of interesting cases of this deviation. I have been here favored with an excellent opportunity of contributing to this department. Bifurcation of fronds is so common here among certain species, as to have ceased to attract any attention. It is quite common in *Cheilanthes lanuginosa*. In this species the forking is always at the apex of the frond. The forks are quite slender, and divided in like manner to the lower pinnae. I do not remember to have seen a forking pinna in this species. But in *C. Eatoni*, while the apices are occasionally seen to fork, the common phenomenon is the forking of the pinnae. In all such cases the forking does not take place at or near the apex of the pinna, but usually below the middle, and often quite near the stalk. The forks are regularly divided, or, at least, quite as regularly as the other portions of the frond, which are themselves quite irregular in their mode of division. But by far the most interesting thing found in my collecting was a frond of this species which bore, at a distance of two or three inches below the lowest pinna, what appeared to be a branch, subtended by a bract. The branch, which, with the bract, was dead and withered when I found it, though the frond was quite green, was probably a sportive pinna, and the bract a much enlarged scale. But the specimen would have well repaid a little study. I laid it away too carefully, for I have been unable to find it since.

While the above-named species have a decided tendency to sport as described, the fern which is pre-eminently characterized by this tendency is the form of *Woodsia Oregana* which I find here, and which, for this reason, I think should be distinguished by name, as a variety. Decidedly more than half of the mature plants are found to be either forked, or presenting the peculiar appearance which invariably precedes the final forked condition. For the fronds are not forked in this species when young, but gradually approach that condition. As the process is most instructive, I will describe it, regretting that time will not permit me to make drawings. Many of my subscribers will receive specimens of the abnormal form, which will serve to illustrate. The lanceolate frond is entirely green and herbaceous. The rachis, as well as the upper part of the stalk, is narrowly winged, often very narrowly. Toward the upper part of the frond this wing becomes indistinct from the widening of the rachis. It widens so as to increase from in width of scarcely a line to near a quarter of an inch, and is surrounded by a narrow wing of incised, almost lacerate frond, this enlarged terminal segment giving to the frond a sort of a lyrate appearance. This segment becomes emarginate as the widened rachis divides, and as the recurved-spreading forks lengthen, the notch in the segment deepens, until we have two distinct and well defined forks. These forks never become long or slender, but exhibit a tendency to fork again in the same manner. Sometimes the pinnae exhibit the same kind of terminal enlargement, but I have not seen one reach the forked state. It is not pleasant to draw conclusions, but it seems as though the seat of the disposition to fork is in the rachis, and

that the extended growth of the segment is in accordance with that of the rachis. This would serve to make plainer the distinction between the frond and the leaf, in which the form of the skeleton is determined by the growth of the parenchyma, which demands support.

Since writing the above, I have found among my specimens of *Pellaea Wrightiana*, a number of specimens of that very rare fern (in the United States), *P. ternifolia*, Link. Upon a careful examination of this fern there seems to be no doubt of the suggestion of Prof. Eaton, that it and *P. Wrightiana* belong to the same species. I shall, therefore, distribute it among my sets, as far as the specimens will go, as *P. ternifolia*, Link, and *P. Wrightiana*, Hooker, as var. *Wrightiana* of the former species.—HENRY H. RUSBY.

**Some Additions to the North American Flora, by Dr. G. Engelmann.**—*DICENTRA OCHROLEUCA*, n. sp. Stem erect, 3-4 feet high, leafy, leaves glaucous, large (lower ones a foot or more long), 3-pinnate, ultimate divisions deeply cleft into lanceolate-linear lobes; flowers paniced on very short pedicels, about 15 lines long, ochroleucous; membranaceous sepals suborbicular; exterior petals slightly saccate at base, upwards narrower, somewhat concave below the acute tip, and scarcely spreading; inner petals widened above into a deep purple circular tip, crested with two very broad flat and elongated appendages; stamens subulate scarcely cohering.

In valleys of the Santa Monica Mountains near Los Angeles, Cal., where it grows with the rather rare *Ceanothus spinosus*, the root-stock of which, named red-wood, furnishes the principal fire-wood there.—Together with *D. chrysantha* this handsome species constitutes the subgenus *Chrysocapnos*, in which the crest, single and inflated in the true *Dicentrae*, is formed of two distinct lamellae, flat and large in our species, short and curly in *D. chrysantha*. This latter is a coarser plant with much smaller golden-yellow flowers (6-9 lines long) and deeply concave, spreading outer petals.

*TSUGA CAROLINIANA*, n. sp. A small tree of the southern Alleghany Mountains with larger (6-8 lines long,  $\frac{3}{4}$ -1 line wide), darker leaves than the common Hemlock spruce, retuse or often notched at tip, without stomata above, beneath with two pale bands, each with 7 or 8 series of stomata; strengthening cells under the epidermis on keel, midrib and edges; cones 12-14 lines long, scales oblong, much longer than wide, in 8-13 order, spreading at right angles after maturity, broad bracts slightly and obtusely cuspidate; seeds (2 lines long) with numerous (15-20) small oil vesicles on the under side, twice shorter than wing.

Mountains of North and South Carolina, on dry slopes and ridges.—Smaller, stouter branched than *T. Canadensis*, from which it is always readily distinguished by its larger, darker, glossier, more retuse leaves and by its larger cones with wide spreading scales. It was first noticed in the mountains of South Carolina by Prof. L. R. Gibbes of Charleston in 1850, who sent specimens to Prof. A. Gray in 1856 and in an accompanying letter suggested for it the name of